

# A Retrospective Panoramic Radiographic Study on Prevalence of Pulp Stones in South Karnataka Population

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## ABSTRACT

**Background:** Pulp stones are calcification in the dental pulp which can be present either in deciduous or permanent teeth. Exact causes of pulp stones are not known and several elements have been associated. It can be seen in healthy, diseased or as a part of various syndromes. Frequency of pulp stones fluctuated from 8 to 95% depending on the population studied. Our study is an attempt to know the prevalence of pulp stones in radiographs of South Karnataka population and to assess probable relations between pulp stones and gender, type of tooth, dental arch and quadrant. Comparison of our results with published documents was done and our study statistics can be considered as an added information in the field of forensic dentistry.

**Materials and methods:** One thousand panoramic radiographs were retrospectively evaluated which included 576 females 424 males aged between 18 and 70 years. A total of 27,184 teeth were examined for the presence of pulp stones. Associations of pulp stones with sex, tooth type, dental arch and side were noted.

**Results:** Pulp stones prevalence was 7.5% of subjects. Out of 27,184 teeth examined, 394 teeth revealed pulp stones (1.45%). Occurrences were rare in premolars (2%) but significantly higher in molars (54.6%). Pulp stones were seen more in first molars than second molars and in maxillary first molars than in mandibular first molars. Pulp stones were commonly seen in 26 to 45 years age group.

**Conclusion:** Pulp stones may provide useful forensic information when examining dental records to identify deceased persons. Dental features vary among different population and thus knowing the prevalence is significant in the forensic aspect.

**Keywords:** Pulp stones, Panoramic radiograph, South Karnataka.

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## INTRODUCTION

Pulp stones are nodular calcified structures which appear in either or both coronal or radicular portion of the dental pulp. It can be present in both deciduous and permanent dentition, healthy or diseased pulp and even in unerupted teeth.<sup>1</sup> Pulp stones may occur freely within the pulp tissue and in dentin and in the latter, it can be either attached or embedded.<sup>2</sup> In a single pulp, quantity of pulp stones can vary from 1 to 12 or more with varying sizes.

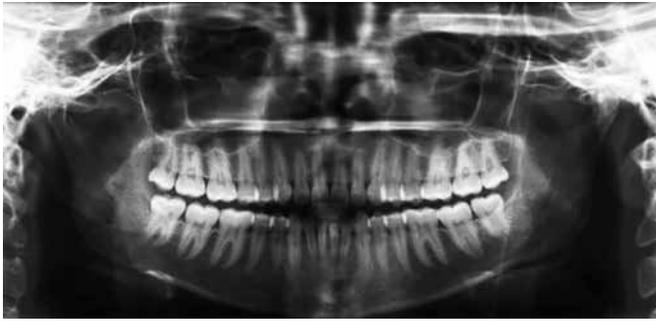
The exact source of pulp stones is unknown. Certain elements have been found to be associated in stone formations which include genetic predisposition, orthodontic treatment, circulatory disturbance in pulp vasculature, age, idiopathic factors, chronic inflammation, chronic irritants like caries and deep restorations. Dentin dysplasia, dentinogenesis imperfecta and Van der Woude syndrome are also associated with pulp stones.<sup>3,4</sup> Radiographic prevalence of pulp stones are reported to be in the range of 8 to 95%.<sup>5,6</sup>

The objective of this radiographic-based study was to determine the prevalence of pulp stones in South Karnataka population, and to assess the likely associations between pulp stones and gender, tooth type, side and to compare the results with review of literature and adding new records in the branch of forensic odontology.

## MATERIALS AND METHODS

A total of 1000 panoramic radiographs of South Karnataka patients were obtained from the Department of Oral Medicine and Radiology, KVG Dental College, Sullia, Karnataka. Digital panoramic radiographs were taken by using Planmeca Proline XC with Dimax 3 digital X-ray unit system machine. Sample composed of 576 females 424 males. Age groups of 18 to 70 years were considered. A total of 27,184 teeth were studied. Panoramic radiographs were examined by two oral and maxillofacial radiologists at the same time.

Study sample excluded teeth with crown or bridge which will obstruct the proper evaluation of pulp. Considering the fact that teeth with deep restorations and carious lesions have a tendency to have more pulp stones, deep carious teeth and large restored teeth were excluded. Cases of syndrome which show increased tendency for pulp stones were not considered for the



**Fig. 1:** Panoramic radiograph showing radiopaque pulp stones in the pulp chamber of molars

evaluation. Definite radiopaque body which is found inside the pulp chamber was considered as pulp stones and a score of present or absent was given (Fig. 1). Score of present was given only after the confirmation of two maxillofacial radiologists. Associations with sex, dental arch and type of tooth were also recorded.

## RESULTS

**Prevalence of pulp stones:** Pulp stone prevalence was 7.5% of the subjects studied. A total of 13,679 maxillary teeth and 13505 mandibular teeth were evaluated. Prevalence per teeth examined was 1.45% (Table 1). Out of 13,679 maxillary teeth examined 234 teeth were having pulp stones (1.71%). A total of 160 of 13,505 mandibular teeth had pulp stones (1.18%).

**Prevalence of pulp stones and distribution between sexes:** Teeth examined in males were 10,881 and the prevalence of pulp stones was 1.41%. Teeth examined in females were 16,303 and prevalence of pulp stones in females was 1.47% (Table 2).

**Pulp stones and tooth types:** First molar showed high number of pulp stones of 54.6% among all teeth which

**Table 1:** Prevalence of pulp stones

	Teeth examined	Teeth with pulp stones
Maxilla	13679	234 (1.71%)
Mandible	13505	160 (1.18%)
Total	27184	394 (1.45%)

**Table 2:** Prevalence of pulp stones and distribution between sexes

	Male		Female	
	Teeth examined	Teeth with pulp stones	Teeth examined	Teeth with pulp stones
Maxilla	5519	88 (1.59%)	8160	146 (1.78%)
Mandible	5362	66 (1.23%)	8143	94 (1.15%)
Total	10881	154 (1.41%)	16303	240 (1.47%)

**Table 3:** Pulp stones and tooth types

	1st molar	2nd molar	Premolar	Total
Maxilla	128 (54.7%)	102 (43.6%)	4 (1.7%)	234 (59.4%)
Mandible	87 (54.4%)	69 (43.1%)	4 (2.5%)	160 (40.6%)
Overall	215 (54.6%)	171 (43.4%)	8 (2.0%)	394 (100%)

**Table 4:** Pulp stone occurrence and dental arches

	1st molar	2nd molar	Premolar	Total
1st quadrant	66 (55.0%)	52 (43.3%)	2 (1.7%)	120 (30.5%)
2nd quadrant	62 (54.4%)	50 (43.8%)	2 (1.8%)	114 (28.9%)
3rd quadrant	43 (53.8%)	35 (43.7%)	2 (2.5%)	80 (20.3%)
4th quadrant	44 (55.0%)	34 (42.5%)	2 (2.5%)	80 (20.3%)
Overall	215 (54.6%)	171 (43.40%)	8 (2.0%)	394 (100%)

was followed by 2nd molar (43.4%) and premolar (2%) (Table 3).

**Pulp stone occurrence and dental arches:** Maxillary 1st and 2nd molar teeth showed slight higher predilection than mandibular teeth (Table 4). In case of premolar teeth, mandibular teeth had increased number of pulp stones than maxillary teeth. In both sex, pulp stones were more in maxillary arch than mandibular arch (Tables 5 and 6).

**Pulp stone occurrence and age group:** Pulp stones were common in 26 to 45 years of age group and the prevalence was similar in 5 to 25 years age group. Pulp stones were comparatively less in 46 to 75 years of age group. The prevalence in 5 to 25 years age group was 55.8 and 55.9% in 26 to 45 years of age group. Prevalence was 50% in 46 to 75 years age group (Table 7).

## DISCUSSION

Radiograph was the criteria for the identification of pulp stones in most of the prevalence studies conducted. The true prevalence is expected to be greater than the radiographic studies because of the fact that pulp stones with a diameter less than 200  $\mu\text{m}$  are not seen on radiographs. Histological studies may also result in under estimation of pulp stones, due to the limited number of section tooth is subjected.<sup>7,8</sup>

Though etiology is unknown, certain conditions are associated with increased pulp stones. A pilot study of relationship of pulp stones and cardiovascular disease showed increased tendency of pulp stones in these patients.<sup>9</sup>

Pulp stones are reported in certain diseases, like tumoral calcinosis, dentin dysplasia type II, Saethre-Chotzen syndrome, familial expansile osteolysis, Ehlers-Danlos syndrome type I, Elfin facies syndrome, osteogenesis imperfecta type I and otodontal syndrome.<sup>10-12</sup>

Local metabolic dysfunction and trauma are the two main proposed causes of pulp stone. Local metabolic dysfunction can precipitate hyalinization and fibrosis. Fibrosis leads to mineralization and this continuous process leads to pulp stone development. Another factor is trauma. Trauma may lead to vascular damage which will precipitate mineralization. It may act as a nidus for further mineralization and thus leads to formation of pulp stone.<sup>13</sup>

**Table 5:** Pulp stone distribution in maxilla and mandible among males and females

	Male				Female			
	1st molar	2nd molar	Premolar	Total	1st molar	2nd molar	Premolar	Total
Maxilla	50 (56.8%)	38 (43.2%)	0	88 (57.1%)	78 (53.4%)	64 (43.8%)	4 (2.7%)	146 (60.8%)
Mandible	38 (57.6%)	28 (42.4%)	0	66 (42.9%)	49 (52.1%)	41 (43.6%)	4 (4.3%)	94 (39.2%)
Overall	88 (57.1%)	66 (42.9%)	0	154 (100%)	127 (52.9%)	105 (43.8%)	8 (3.3%)	240 (100.0%)

**Table 6:** Pulp stone distribution in all quadrants among males and females

	Male				Female			
	1st molar	2nd molar	Premolar	Total	1st molar	2nd molar	Premolar	Total
1st quadrant	26 (57.8%)	19 (42.2%)	0	45 (29.2%)	40 (53.3%)	33 (44.0%)	2 (2.7%)	75 (31.2%)
2nd quadrant	24 (55.8%)	19 (44.2%)	0	43 (27.9%)	38 (53.5%)	31 (43.7%)	2 (2.8%)	71 (29.6%)
3rd quadrant	19 (57.6%)	14 (42.4%)	0	33 (21.42%)	24 (51.1%)	21 (44.7%)	2 (4.2%)	47 (19.6%)
4th quadrant	19 (57.6%)	14 (42.4%)	0	33 (21.42%)	25 (53.2%)	20 (42.6%)	2 (4.2%)	47 (19.6%)
Overall	88 (57.1%)	66 (42.9%)	0	154 (100%)	127 (52.9%)	105 (43.8%)	8 (3.3%)	240 (100.0%)

**Table 7:** Pulp stone distribution among different age group

Age groups	Teeth with pulp stone				
		1st molar	2nd molar	Premolar	Total
5–25 years	1st quadrant	22 (55.0%)	17 (42.5%)	1 (2.5%)	40 (31.0%)
	2nd quadrant	22 (56.4%)	16 (41.0%)	1 (2.6%)	39 (30.2%)
	3rd quadrant	14 (56.0%)	10 (40.0%)	1 (4.0%)	25 (19.4%)
	4th quadrant	14 (56.0%)	10 (40.0%)	1 (4.0%)	25 (19.4%)
	Overall	72 (55.8%)	53 (41.1%)	4 (3.1%)	129 (100.0%)
26–45 years	1st quadrant	31 (55.4%)	25 (44.6%)	0	56 (31.3%)
	2nd quadrant	29 (56.9%)	22 (43.1%)	0	51 (28.5%)
	3rd quadrant	20 (55.6%)	16 (44.4%)	0	36 (20.1%)
	4th quadrant	20 (55.6%)	16 (44.4%)	0	36 (20.1%)
	Overall	100 (55.9%)	79 (44.1%)	0	179 (100.0%)
46–65 years	1st quadrant	13 (54.2%)	10 (41.6%)	1 (4.2%)	24 (27.9%)
	2nd quadrant	11 (45.8%)	12 (50.0%)	1 (4.2%)	24 (27.9%)
	3rd quadrant	9 (47.4%)	9 (47.4%)	1 (5.2%)	19 (22.1%)
	4th quadrant	10 (52.6%)	8 (42.1%)	1 (5.3%)	19 (22.1%)
	Overall	43 (50.0%)	39 (45.3%)	4 (4.7%)	86 (100.0%)

Pulp stones possibly cause problems during endodontic therapy for the canal location and negotiation. In forensic dentistry, it can provide a valuable tool in radiographic comparison of pulp stone configurations. Along with other dental information in the records, it may provide valuable evidence in the identification of deceased individuals.<sup>14</sup> Pulp stones may be just an incidental finding not the cause in cases of unexplained pulp-related pain.<sup>17</sup>

In the present study, the prevalence of pulp stones was 7.5% of the 1000 subjects studied and 1.45% per 27,184 teeth examined. The prevalence was lower compared to Tamse et al<sup>15</sup> (20.7% of teeth), Baghdady et al<sup>15</sup> (19.2% of teeth), Hamasha and Darwazeh<sup>16</sup> (51.4% of the patients and 22.4% of teeth), Ranjitkar et al<sup>17</sup> (46.1% of the subjects and 10.1% of the teeth), Chandler et al<sup>18</sup> (9.9% of person and 4% per teeth), Zainab and Najmeed<sup>19</sup> (34.8% in the subjects and 7.3% per teeth), Sisman et al<sup>1</sup> (57.6% prevalence of pulp stones per patients and 15% of teeth), Sreelakshmi et al<sup>20</sup> (53.3% of the subjects and 6.4% of the

total teeth). Study by Ilday et al<sup>21</sup> included a large sample and showed a low prevalence than our study (3.5% of the patients and 0.5% of the teeth). Our study population examined 27184 teeth which is one of the largest number of sample size considering the published literature which may be a reason for the comparative low prevalence.

When compared to teeth type and pulp stones, first molar showed increased prevalence of pulp stones. This finding was in agreement with studies by Sisman et al,<sup>1</sup> Tamse et al,<sup>15</sup> and Ranjitkar et al.<sup>17</sup> However, it was not in agreement with the study done by Hamasha and Darwazeh,<sup>16</sup> who found more distribution in the mandibular molars. Being the first tooth to erupt in the oral cavity, molars bear more occlusal forces leading to early degenerative changes. Rich blood supply in molar leading to increased calcification is another proposed factor.<sup>20</sup>

As per our study, prevalence of pulp stones in males and females were comparable, with a very slight female predominance which was statistically insignificant.



Baghdady et al,<sup>5</sup> Tamse et al<sup>15</sup> and Sisman Y,<sup>1</sup> found a female predilection for pulp stones. Hamasha and Darwazeh<sup>16</sup> found a male predominance for pulp stones though the difference was not statistically significant. Study by Turkal et al<sup>22</sup> showed more pulp stones in males which were statistically significant. There are many studies in the literature, which report that pulp calcifications are age-related phenomenon. However, in the present study, an age group of 18 to 70 years was considered, most of the patients with pulp calcifications were within the age group of 26 to 45 and 5 to 25 years. The age being a reason for increased pulp stones was not proved in our study. This finding was in accordance with Satheeshkumar et al<sup>23</sup> study, where he concluded that aging and the reactive process may not be the only reason for pulp calcifications. Association of pulp stones and systemic disorders in this context leads to a controversy.

Our study limitations would be the method of radiographic assessment used. Panoramic radiographs may not give a clear picture of pulp stones in the anterior teeth. Bitewings are preferred as it gives a better image with enhanced definition of the pulp chamber. But, one of the main advantages of panoramic radiograph is that it shows both jaws on a single radiographic image. We could evaluate the entire dentition in a panoramic radiograph for pulp stones retrospectively without exposing the patient again for bitewing. It would be an excellent radiograph for screening pulpal calcifications.<sup>24</sup>

## CONCLUSION

It may provide additional information about the dental morphological features of South Karnataka population from the noted features of pulp stones in this study. System to denote number and size of pulp stones in radiographs would further assist in forensic applications.

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